NORTH CAROLINA GEOLOGICAL AND ECONOMIC SURVEY

ECONOMIC PAPER NO. 53

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NORTH CAROLINA GEOLOGICAL AND ECONOMIC SURVEY
JOSEPH HYDE PRATT, DIRECTOR

ECONOMIC PAPER No. 53

WATER POWER SURVEY OF SURRY AND WILKES COUNTIES

BY
THORNDIKE SAVILLE, HYDRAULIC ENGINEER

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NORTH CAROLINA STATE

LETTER OF TRANSMITTAL

Chapel Hill, N. C., March 20, 1922.

To His Excellency, Cameron Morrison,
Governor of North Carolina.

Sir:—There is herewith submitted manuscript on "A Water Power Survey of Surry and Wilkes Counties," which has been made in co-operation with the county commissioners of these two counties; and it is recommended that this report be published as Economic Paper No. 53 of the publications of the North Carolina Geological and Economic Survey.

This is the first of a series of reports that are being made on the water powers of the several counties of the State in coöperation with the boards of county commissioners.

Yours respectfully,

Joseph Hyde Pratt, *Director,*
North Carolina Geological and Economic Survey.

56642

CONTENTS

PAGE

Preface 7

PART I

Water Powers of Surry County 13
- Introduction 13
- Location 13
- Climate 13
- Agriculture 13
- Manufactures 13
- Transportation 13

Water Powers 14
- Definitions Relating to Water Powers 14
- Stream Flow 14
- Cubic Feet per Second by Square Miles 14
- Storage 14
- Pondage 14
- Gaging Station 15
- Flow of Stream 15
- Horsepower 15
- Primary Power 15
- Secondary Power 15
- Profile 15
- Cross Section 15
- Topographic Map 15
- Ararat River 15
- Matthews Dam 16
- Hiatts Dam 16
- Fisher River 18
- Horseshoe Bend 19
- Skull Camp Mountain Site 20
- Mitchell River 20
- Kapps Mill Site 20
- Elkin River 20
- Yadkin River 21
- Bean Shoals 21

Interconnection of Power Plants 22

PART II

PAGE

Water Powers of Wilkes County 31
Introduction 31
Location 31
Climate 31
Agriculture 31
Forests 31
Manufactures 32
Transportation 32

Water Powers 33
Elkin River 33
Roaring River 33
Reddies River 34
Lewis Fork 35
Elk Creek 36
Yadkin River 36
Tinsley Shoals 37
Barlow Shoals 37

Summary 37

Interconnection of Power Plants 37

Gaging Stations 39

PREFACE

The present report on a "Water Power Survey of Surry and Wilkes Counties" was prepared by the North Carolina Geological and Economic Survey in coöperation with the boards of county commissioners of the counties, and is the first of a series of such reports that the Survey hopes to be able to bring out covering the water power resources of each county of the State. The value of these reports has already been demonstrated by the use that has been made of the present report while in manuscript form. Plans for the development of several water powers described in the report have already been made.

The board of commissioners of Surry County consisted of Thomas Fawcett, Mount Airy; A. W. George, Elkin, and S. F. Shelton, Mount Airy, R. F. D., and the board of commissioners of Wilkes County were D. C. Sebastian, Hayes; D. V. Nichols, Purlear, and C. M. Caudill, Traphill.

Joseph Hyde Pratt, *Director,*
North Carolina Geological and Economic Survey.

PART I

WATER POWERS OF SURRY COUNTY

BY

THORNDIKE SAVILLE, Hydraulic Engineer

PART I

LIST OF MAPS AND DIAGRAMS

[Enclosed in Pocket Attached to Back Cover]

Fig. 1. Map of Surry County, showing streams, roads, and dam sites.
Fig. 2. Profile of the Ararat River.
Fig. 3. Map and section of Matthews Mill Dam site.
Fig. 4. Cross sections of dam sites on Ararat River.
Fig. 5. Topographic map of Hiatt's dam site.
Fig. 6. Profile of the Fisher River, with cross sections of dam sites.
Fig. 7. Map of Horseshoe Bend Dam site, Fisher River.
Fig. 8. Profile of the Mitchell River, with cross sections of dam sites.
Fig. 9. Profile of the Yadkin River, Bean Shoals to North Wilkesboro, N. C.
Fig. 10. Plan and profile of the Yadkin River at Bean Shoals.
Fig. 11. Profile of the Yadkin River and Southern Railroad at Bean Shoals.
Fig. 12. Topographic map at Bean Shoals Dam site.
Fig. 13. Cross section of Bean Shoals Dam site on the Yadkin.
Fig. 15. Map of Yadkin River from Salisbury to North Wilkesboro.
Fig. 16. Duration curves of Run-off from Yadkin River at Salisbury.

LIST OF TABLES

		PAGE
Table I.	Power available at dam sites on Surry County streams	17
Table II.	Discharge of Ararat River at Pilot Mountain, N. C.	18
Table III.	Gage Heights of Dobson, N. C.	20
Table IV.	Backwater elevations from dam at Bean Shoals	22
Table V.	Discharge of Yadkin River at Donnaha	24

PART I

WATER POWER SURVEY OF SURRY COUNTY

By THORNDIKE SAVILLE, *Hydraulic Engineer*

INTRODUCTION

Location.—Surry County is the northernmost county in the State abutting on the eastern slope of the Blue Ridge. It is bounded on the north by Patrick County, Virginia, and on the east, south, and west respectively by Stokes, Yadkin, and Alleghany counties, North Carolina. Its elevation above sea level is generally high, varying from about 600 feet at Boyden on the Yadkin River near the southeast corner of the county to 3,609 feet at Fisher Peak on the Blue Ridge. A map of the county will be found in the pocket at end of report.

Climate.—The climate is that of the upper Piedmont region. At Mount Airy, the principal city, elevation 1,048, there is a mean annual rainfall of about 47 inches; the average, mean maximum, and mean minimum temperatures are 56, 68, and 44 degrees, respectively. The extremes of temperature range from a maximum of 103 to a minimum of —15 degrees Fahrenheit. The average date of the first and last killing frosts is October 17 and April 21, respectively. The climate is considerably more moderate in the southern part of the county, especially in the wide and fertile valley of the Yadkin.

Agriculture.—In the middle and southern parts of the county, especially in the river valleys, a great deal of fine tobacco is raised. On the uplands cotton and corn are the staple products. In the mountainous districts the county is famous for its fine fruit and vegetables, great quantities of apples, cabbage, etc., being shipped to market. Mount Airy is the greatest cabbage market south of New York.

Manufactures.—The furniture industry thrives at Mount Airy, due to the excellent timber still remaining in the county. The chief industry is the quarrying and cutting of granite, the Mount Airy granite being known and used all over the United States for building and monumental stone. There are a number of cotton mills and gins throughout the county.

Transportation.—The Southern Railroad branch line between Winston-Salem and North Wilkesboro parallels the southern edge of the county along the Yadkin River. The Atlantic and Yadkin Railroad from Greensboro, runs from Pilot Mountain to Mount Airy in Surry County. These two railroads serve a considerable territory devoted to the pursuits noted above, and are not far distant from the streams

where good water-power sites are available. Good roads are being rapidly constructed to bring the more remote districts into communication with the railroad and manufacturing centers.

WATER POWERS

The principal streams of the region, in order of importance, are the Yadkin, Ararat, Fishers, and Mitchell rivers. Elkin River cuts across the southeastern edge of the county for a few miles. The natural flow of the streams in the northeastern section of this county is as constant as in any other district in the State—the rainfall being distributed over the year, and the mountain sides having a strong second growth, which retards flood discharges, while the rocky character of the upland regions gives a large total yield of the rainfall falling upon the surface.

There are no great water powers in excess of 5,000 horsepower available in the region other than that at Bean Shoals, on the Yadkin. There are a number of excellent sites, however, where from 500 to 2,000 continuous primary horsepower may be developed, and this may, in some instances, be more than doubled by pondage, permitting a 10-hour or 12-hour utilization of flow. In nearly every instance these sites are located within five or ten miles of good railway facilities, and a hydroelectric plant on the streams may easily generate power to be transmitted a short distance to manufacturing plants located on the railroads.

In general, the valleys are narrow and no large storage is possible at dam sites. To develop the streams for maximum power will mean steam auxiliary or interconnection with some large station, such as might be constructed at Bean Shoals. At many sites, however, the continuous flow of the stream is sufficient to supply constant power up to from 500 to 2,000 horsepower.

Definitions relating to water powers.—The following definitions are given to enable the nontechnical reader to utilize this report.

Stream flow.—The amount of water flowing in the stream under given conditions, measured in cubic feet per second. One cubic foot equals 7½ gallons.

Cubic feet per second per square mile.—The amount of water in cubic feet per second flowing from each square mile of the drainage area under the given conditions.

Storage.—The amount of water in cubic feet, or other unit, which may be impounded behind a dam and used to supplement the flow of the stream during extended periods (several weeks) of low flow. The effect is to increase the amount of continuous flow at the dam site.

Pondage.—The amount of water in cubic feet or other unit which may be impounded behind a dam and used to collect the flow of the stream for a short period, usually from 12 to 14 hours, when the plant is not in use. It is a much smaller volume of water than that necessary for storage. The effect is to enable the plant to use in 10 or 12 hours the entire flow of the stream for 24 hours.

Gaging station.—A place on the river where occasional measurements of stream flow are made by means of an instrument known as a current meter. A pennant staff gage is usually installed at these places, which is graduated to read the height of the water surface in feet and tenths of a foot. By daily observations of the staff gage after measurements have been made by the current meter, the engineer is able to compute the amount of water flowing in the stream each day.

Flow of streams.—The average annual flow of the streams of the region may be taken as approximately 1.8 cubic feet per second per square mile of drainage area. The average minimum monthly flow during the dry season is between 0.7 and 1.2 second feet per square mile. The minimum flow for the highest six months in the year is about 1.2 second feet per square mile. The minimum daily flow in one year averages about 0.5 second feet per square mile.

Horsepower.—The horsepower which can be developed from a stream is dependent both upon the amount of water flowing and the height through which it may be made to fall by means of a dam or other device. A rough method for determining the horsepower available for use is to multiply the stream flow in cubic feet per second by the height of fall and divide by eleven. It is thus evident that while there may be a very high fall, the horsepower that can be developed is not large unless there is a considerable amount of water flowing.

Primary power.—The amount of power that can be developed on the average for twelve months in the year. It is usually a small percentage of the average power which can be generated by a stream if storage or auxiliary power is available.

Secondary power.—The amount of power that can be developed for periods shorter than the entire year, as for nine or ten months when the stream flow is not a minimum. To make up the deficiency due to low stream flow some sort of storage or auxiliary power is needed.

Profile.—A diagram which shows the relative elevation above some given place of points along a stream bed.

Cross section.—A diagram showing the position and elevation of the banks of a stream at a dam site with reference to the bed of the stream.

Topographic map.—A map or plan of a district showing by means of contour lines the elevation of different points in the district with reference to some established point. Such a map shows the relative elevations and location of ground above a dam site, and from it the amount of water to be impounded by the dam can be found and the area which it will flood back of the dam.

ARARAT RIVER

This is the largest of the streams of Surry County tributary to the Yadkin. It enters that river between Shoals and Siloam, and extends in a generally northern direction from its mouth to Mount Airy. The drainage area at the mouth is about 295 square miles. Above Mount

Airy it is improbable that sites exist for economically developing over 500 horsepower. A profile of the river bottom was run from the mouth to the bridge at Douglass Ford on the Pilot Mountain-Dobson road, a distance of about twelve miles. This is shown in Fig. 2. One or two possible dam sites exist below the Shoals bridge, but there is little fall available, large areas of valuable land would be flooded, and back water from the Yadkin would frequently interfere with plant operation.

The first practicable dam site is located about three miles above the mouth. There are here some shoals giving a fall of about eight feet. A profile of this section of the river, with cross section of dam site, is shown in Figs. 2 and 4.

Matthews Dam.—The first really excellent dam site is that at Matthews Dam, about one mile above the Shoals bridge at Harlan Ford, and five miles above the mouth of the river. At present there is a new timber crib dam here, eight feet high, which was used to run a grist mill not now in use. A cross section of this site is shown on Fig. 3, indicating the steep and high banks. It would be possible to construct a 72-foot dam, giving an 80-foot fall, impounding water back to Ararat Station on the Atlantic and Yadkin Railroad and giving excellent storage. It is estimated that about 4,000 24-hour horsepower, or 9,600 10-hour horsepower, could be constantly maintained without use of auxiliary power. The site is located near a good road and about 3 miles from Siloam Station of the Southern Railroad. It should be noted that if the Bean Shoals development on the Yadkin is ever made, backwater from this might occasionally handicap the Matthews Dam plant. The Bean Shoals development is at present a rather remote possibility, owing to the presence of the railroad, and in the event it is ever made, damages could be collected for any impairment of earlier developments. The Matthews mill-dam site is regarded as capable of the best and greatest power development on the Ararat River. It is readily accessible for construction, is near to good transportation facilities, and the back water above the dam will flood only a moderate amount of cultivable bottom lands. Its construction would eliminate development of all other dam sites on the Ararat described hereafter.

The third dam site, at station 305+43, is shown in cross section on Fig. 4, and is located at the horseshoe bend above Whitt Ford. It is located at the bottom of some shoals, giving a fall of about 5 feet. The hills on each side are rock and foundation conditions good.

The fourth site is at station 205+20, and is one of the best on the river from a construction point of view.

Hiatt's Dam.—The fifth site is known as Hiatt's dam site. There has been much agitation in Pilot Mountain to develop here an installation to furnish power for the town. For this reason a small contour map of the area above the dam site was made and is shown in Fig. 5. This site is so high up on the river that a dam would be limited to about

20 feet high. Otherwise the railroad would be flooded above Ararat Station. Relocation is out of the question. Not more than 300 minimum 12-hour horsepower could be developed here without auxiliary power to carry the plant over periods of low water. It might be economical to develop for possibly 700 horsepower, which with pondage for 12 hours per day could probably be counted on during 10 months in the year. The site is not regarded as offering nearly so good a development as the next one below, at station 123+19.

With the maximum development at each dam site which will not interfere with the development of the next site up stream, and by development of all sites, 1,260 24-hour primary horsepower can be developed, whereas the maximum development at Matthews Dam would alone give 4,000 primary horsepower. It is evident that the latter development is by far the most satisfactory to make, both from the standpoint of cost and economy in operation. It is much to be hoped that the interests along the river will combine to develop this single power to their mutual advantage.

TABLE I.—POWER AVAILABLE AT DAM SITES ON SURRY COUNTY STREAMS

River	Location	Drainage Area, Tributary Square Miles	Maximum Fall in Feet	Minimum Power Without Storage	Horsepower Available with Storage		
					12 Months	6 Months	3 Months
Yadkin	Bean Shoals	1,300	15	1,400	2,660	4,750	5,300
	Bean Shoals	1,300	100	11,800	23,600	35,000	47,000
Ararat	Mouth	230					
	Station	280					
	Matthews Mill—Sta. 397+68	270	80	1,965	3,930	6,900	7,850
	Horseshoe Bend—						
	Sta. 305+43	240	60	1,050	2,620	3,930	5,240
	Sta. 205+20	230	50	836	1,565	2,090	3,140
	Sta. 123+19	220	42	673	1,000	1,510	2,100
	Hiatt's Sta. 15+70	200	20	290	363	545	728
Fisher	Mouth	156					
	Horseshoe Falls	112	100	815	2,040	3,050	4,070
	Skull Camp Mountain	28	200	510	1,020	1,530	2,040
Mitchell	Mouth	{112 {110					
	Kapp's Mill	38	100	345	690	1,035	1,380

NOTE.—To obtain 12-hour power multiply figures given by 2. To obtain 10-hour power multiply figures given by 2.4.

The stations shown in Table I, and on Figs. 2 and 4, indicate the distance in hundreds of feet below the highway bridge at Douglass Ford. Above this point developments in excess of 500 horsepower cannot be

made, owing to the proximity of the railroad to the river between Ararat and Mount Airy. Above Mount Airy there are a number of sites which might be developed up to 400 horse power—but none were examined which seemed possible of economical development to as much as 500 horsepower. All sites noted above are shown on the general sketch map of Surry County attached hereto. Table II gives monthly discharge at the highway bridge at Douglass Ford from October, 1920, to February, 1922, inclusive. This station was established in the summer of 1920, and daily observations have been taken since September, 1920.

TABLE II.—DISCHARGE OF THE ARARAT RIVER AT PILOT MOUNTAIN, N. C.
Drainage Area, 200 Square Miles

Year	Month	Discharge in Second-feet				Run-off Depth in Inches on Drainage Area
		Maximum	Minimum	Mean	Per Square Mile	
1920	August	1,193	215	525	2.62	2.97
	September	1,340	215	367	1.83	2.04
	October	470	143	232	1.16	1.32
	November	2,540	171	495	2.48	2.76
	December	3,000	415	679	3.40	3.86
1921	January	2,750	360	627	3.13	3.55
	February	2,535	472	723	3.62	3.77
	March	710	400	456	2.28	2.58
	April	2,090	318	551	2.75	3.07
	May	730	360	453	2.26	2.57
	June	1,240	230	392	1.96	2.19
	July	1,520	190	410	2.05	2.32
	August	340	132	215	1.06	1.20
	September	610	80	180	.80	1.01
	October	2,710	75	216	1.08	1.23
	November	1,490	190	320	1.63	1.82
	December	350	115	219	1.10	1.24
	The year	2,750	75	392	1.985	26.45
1922	January	720	138	248	1.24	1.40
	February	1,222	298	504	2.52	2.85

FISHER RIVER

The Fisher River is quite lacking in really excellent dam sites, that at the Horseshoe Bend, southeast of Dobson, being the only one of note on the river. The river makes a sharp bend here, flowing in a narrow gorge over a series of shoals, giving a total fall of about 10 feet. A profile of the river from the highway bridge below Bear Creek to the highway bridge from Dobson to Mount Airy is shown on Fig. 6.

Horseshoe Bend.—There is also shown on the same figure a cross section of the dam site at the Horseshoe Bend. It should be noted that there is a gap beyond the crest of the hill on the right bank, and this

precludes a higher dam than 50 feet without a dike across this saddle. A 50-foot dam would develop about 760 continuous primary horsepower, or 1,800 10-hour primary power with storage. With auxiliary power, a development could well be made for probably 50 per cent in excess of these figures.

It would be quite feasible to construct here a dam 100 feet or more in height, but this would necessitate a dike across the gap. Either dam would mean relocation of the present Mount Airy-Dobson highway. A 100-foot dam would develop probably 2,000 continuous or 6,000 12-hour primary power. With auxiliary power it would be economical to develop possibly 4,000 or 4,500 horsepower for general use, or for an electric furnace or other similar industry. No local market exists as yet for the use of so much power. This development, however, is one of the most attractive in the region, and owing to the exceptional dam site could be constructed relatively cheaply. Some valuable agricultural land would, however, be flooded. A contour map of the region immediately above the dam site is shown in Fig. 7. A scheme for interconnection of this power with others is considered later in the report.

TABLE III.—GAGE HEIGHTS ON FISHER RIVER, DOBSON, N. C.—1920–1921

	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	
1	------	0.77	0.72	1.97	1.73	1.12	1.02	0.88	0.87	0.73	0.77	0.77	0.49	1
2	------	.73	.72	1.95	1.72	1.12	1.02	.92	.93	.67	.78	.73	.61	2
3	------	.82	.68	1.92	1.73	1.14	1.02	.85	.97	.73	.77	.77	.56	3
4	------	.77	.67	1.86	1.72	1.13	.97	.82	.93	.87	.73	.78	.50	4
5	.75	.75	.64	1.83	1.72	1.17	.94	.77	.85	.73	.74	.86	.52	5
6	.73	.72	.62	1.82	1.72	1.12	.97	.73	.75	.72	.72	.84	.52	6
7	.78	.72	1.62	1.96	1.67	1.15	.95	.78	.73	.75	.67	.86	.49	7
8	.73	.72	1.73	1.93	1.73	1.17	.93	.77	.97	.78	.63	.87	.51	8
9	.78	.72	1.73	1.85	1.73	1.18	.87	.83	.93	.83	.57	.94	.74	9
10	.75	.72	1.85	1.73	1.76	3.12	.85	.73	.87	.87	.73	.95	.51	10
11	.73	.72	1.93	1.75	1.84	1.18	.83	.72	.87	.88	.74	.94	.52	11
12	.72	.68	1.95	1.85	1.83	1.13	.78	.77	.77	.73	.73	.87	.51	12
13	.75	.66	1.82	4.05	1.77	1.13	.74	.83	.74	.72	.75	.85	.47	13
14	.73	.64	1.93	5.05	1.98	1.15	.75	.73	.87	.67	.77	.94	.47	14
15	.83	.72	2.05	1.32	1.82	1.12	.74	.83	.87	.64	.76	.95	.45	15
16	.75	.72	2.45	1.34	1.77	1.07	.73	.92	.83	.67	.78	.97	.46	16
17	.73	.72	2.82	1.13	1.75	1.06	.73	.97	.83	.72	.93	.87	.48	17
18	.72	.72	1.93	1.93	1.72	1.12	.75	.93	.77	.63	.92	.84	.46	18
19	.77	.72	1.83	1.82	1.82	1.13	.72	.87	.73	.73	.87	.86	.46	19
20	.75	.72	1.82	1.73	1.77	1.17	.73	.83	.77	.74	.83	.88	.45	20
21	.73	.72	1.82	1.75	1.73	1.20	.74	.77	.73	.73	.78	.54	.48	21
22	.62	.72	1.95	1.77	1.72	1.17	.77	.73	.87	.68	.76	.54	.70	22
23	.65	.72	1.97	1.03	1.14	1.15	.83	.77	.83	.64	.74	.53	.51	23
24	2.55	.72	1.92	1.87	1.13	1.12	.87	.83	.87	.67	.97	.52	.47	24
25	.77	.72	1.82	1.77	1.03	1.12	.85	.77	.95	.74	.95	.55	.49	25
26	.75	.72	1.73	1.75	1.05	1.07	.77	.73	.93	.73	.87	.55	.52	26
27	.72	.72	1.75	1.73	1.03	1.05	.73	.83	.73	.74	.85	.53	.51	27
28	.78	.82	1.73	1.83	1.02	1.03	.72	.93	.77	.72	.73	.48	.51	28
29	.77	.75	1.70	1.82	1.04	------	.75	.97	.87	.74	.78	.51	.50	29
30	1.52	.72	1.97	1.77	1.15	------	.78	.97	.83	.78	.76	.55	.54	30
31	------	.72	------	1.75	1.13	------	.83	------	.77	------	.75	.51	------	31

Skull Camp Mountain Site.—There is an excellent dam site at the foot of Skull Camp Mountain, where a 200-foot dam could be constructed. This would necessitate a long earth section, but there is excellent storage above the site. It is probable that from 1,200 to 1,800 primary continuous power could be developed here, which could readily be interconnected with the development near Dobson noted above.

No other exceptionally good dam sites were noted on Fisher River. In general, where the banks are steep on one side, the valley is broad on the other. A number of sites exist where low dams might be cheaply constructed to develop from 100 to 400 primary horsepower. Gage readings at Dobson from October, 1920, to March, 1921, inclusive, are given in Table III. A rating curve has not yet been constructed, but will be prepared within a few months.

MITCHELL RIVER

This river, like the Fisher, presents few opportunities for economical development of dam sites to produce in excess of 500 primary horsepower. About one mile above Douglass mill dam, and about 1½ miles above the mouth is a possible site where a dam 40 feet high would develop about 350 continuous primary horsepower, or 700 12-hour horsepower. From this point up the river no really good dam sites occur until Kapp's mill is reached, and about 10 miles above the mouth. The river has a much steeper slope than either the Ararat or Fisher rivers, rising about 15 feet per mile. It is possible, therefore, to develop low dams from 8 to 12 feet high at a number of places and gain additional height by means of a flume or canal carried along the banks. The power to be obtained by such developments may be said roughly to approximate 7 continuous primary horsepower per foot of fall.

Kapp's Mill Site.—At Kapp's mill a fair dam site exists. A cross section of this, together with profile of the river, is shown on Fig. 8. A dam 100 feet high would develop approximately 700 primary continuous power, or a 10-hour power of 1,680 horsepower.

On the headwaters of the Mitchell River some high falls are available, up to 250 feet, but although as much as 500 continuous primary horsepower could be developed at some of these, the remote location, and the difficulty of getting in construction materials make them not feasible economically for development at the present time.

ELKIN RIVER

This stream flows for only a few miles in Surry County, and no undeveloped dam sites are available. A description of the powers on the upper part of this stream will be found in the report on the water powers of Wilkes County.

YADKIN RIVER

Bean Shoals.—The Yadkin River forms the southern boundary of Surry County, and at Bean Shoals, between Boyden and Shoals on the Southern Railroad is located the best undeveloped power in Surry County. The shoals here extend a distance of six miles from Shoals Station to Donnaha, with a total fall of 40 feet. By far the larger amount, however, occurs in the two miles between Shoals and Boyden stations, the fall in this distance being 27 feet. No dam sites as good as at Shoals occur below this point, and the remaining fall of the shoals is not regarded as possible of economical development in the near future.

There are two good dam sites located near the foot of the first portion of the falls, about one-half mile west of Boyden Station. There are rock hills coming close to the river on each side, and at one site there is a large island in the middle of the stream, which would greatly simplify construction. The rock lies on edge normal to the direction of the river, and foundations for any type of masonry dam would be excellent. Due to the presence of the railroad, construction materials could readily be brought in, and there is an abundance of local sand and rock.

The chief drawback to the early development of these sites is the location of the North Wilkesboro branch of the Southern Railroad, which runs parallel to the river, and not far above it. Any development for more than 15 feet at the dam would necessitate relocation of the railroad. It should be said in this connection that a line has been surveyed from Shoals to Tobaccoville by another route, following a higher contour. Such relocation would be very advantageous in eliminating costly grades between Shoals and Tobaccoville on the present line. By removing the railroad, a dam from 60 to 100 or more feet in height could readily be built. The limit in height would depend chiefly on the cost of flood rights, for a dam 180 feet high would back water to North Wilkesboro, 53 miles above, and would flood portions of the town of Elkin, and quite submerge the small villages of Burch, Crutchfield, and Rockford, as well as much valuable bottom land.

Table IV shows the distance to which backwater would rise from dams of different heights. It is believed that it will never prove profitable to flood Elkin, and the maximum height of dam is thus limited to about 112 feet. This would develop at least 26,400 primary continuous horsepower. The data in Table IV relating to power capable of being developed are extremely conservative, and in most instances the figures there given will probably be exceeded in practice. Profiles of Bean Shoals are shown in Figs. 9 and 10. The profile of the Yadkin River, Fig. 9 (in pocket), shows the rise from the foot of Bean Shoals to North Wilkesboro, and data in Table IV is taken from this. Fig. 12 shows a contour map from the dam site to above Shoals Station. Some idea of the character of the valley and the amount of storage may be obtained from this, and also from the general maps of the Yadkin Valley, Fig. 15.

TABLE IV.—BACKWATER ELEVATIONS FROM DAM AT BEAN SHOALS ON YADKIN RIVER
Drainage Area, 1,300 Square Miles

Height of Dam in Feet	Backwater Reaches to—	Horsepower Developed		
		12 Months	6 Months	3 Months
18	Railroad below Shoals	1,700	4,250	6,350
30	Siloam Station	3,550	7,100	10,650
40	Railroad at Siloam Station	4,750	9,460	13,190
55	Rockford	7,800	13,000	19,500
64	Railroad at Rockford	11,350	18,900	26,500
78	Crutchfield	16,600	23,000	27,600
88	Railroad at Crutchfield	20,800	31,200	41,600
112	Elkin	26,400	29,700	52,800
135	Railroad at Elkin	31,900	47,800	63,800
135	Ronda			
145	Railroad at Ronda			
187	North Wilkesboro			
200	Railroad at North Wilkesboro			

Fig. 11 shows relative profiles of the river bottom and railroad from the dam site to Shoals. It is evident that under present conditions a 15-foot dam might be built without flooding the railroad, especially if the channels were widened by cutting into each side of the island. Such a dam would be about 1,100 feet long, and would develop approximately 1,400 continuous or 3,360 10-hour primary horsepower. The storage developed is about 85,000,000 cubic feet. The drainage area above the dam site is about 1,300 square miles and this figure may be used in computing storage. The percentage of time that given flow and power can be maintained are derived from the duration curves of Fig. 16. In a general way data from Fig. 16 is applicable to all the streams in Surry County.

INTERCONNECTION OF POWER PLANTS

In the development of hydro-electric projects in a new country, such as the region about Surry County, it is greatly to be desired that all installations be planned with a view to eventual interconnection. In this way, when the load at one place is high surplus power from another place may be brought in. It is thus possible to have smaller machinery installations at a given plant, with consequent less idle machinery during periods of average load. Interconnection of plants means much greater economy in operation, and usually less initial cost. Frequently it is possible to do away with steam auxiliary.

For this reason there has been indicated on the sketch map of Surry County a transmission line connecting the principal developments noted above. It is strongly urged that any enterprises looking to the development of one or more of the sites described herein should consider very

carefully the construction of a unit which will fit into this interconnected system. Eventually it is hoped that the whole State will be served by a network of interconnected transmission lines.

A very desirable scheme would seem to be the development of Matthews dam site, on the Ararat, with the Horseshoe dam site on the Fishers River—interconnection of the two, and transmission for use to Winston-Salem. Primary power of 6,000 continuous horsepower could probably be developed, and by use of auxiliary power at Winston-Salem the two projects could probably be developed for between 8,000 and 10,000 horsepower. The distance from Horseshoe Bend on Fishers River to Matthews mill on the Ararat is about 10 miles, and from Matthews mill to Winston-Salem the distance is about 25 miles. It would probably be more attractive still to construct a longer transmission line, by going from Horseshoe Bend to Dobson, thence to Mount Airy, then south along the railroad to Rural Hall and Winston-Salem. A considerable market for power exists in all the small towns along the line, and the existing hydro-electric plant on the Ararat at Mount Airy could then be tied in. The capacity of the whole system, with Matthews mill connected in, would then be in the neighborhood of 7,000 primary continuous horsepower, and could well support an installation of 12,000 horsepower with auxiliary power. At Winston-Salem it would, of course, be possible, and probably desirable, to tie into the Southern Power Company's lines.

In connection with any scheme of interconnection of powers in this region, the counties of Surry, Wilkes, and Ashe should be regarded as a unit. The interconnection of powers on Roaring, Reddies, and the New rivers mentioned in the Wilkes County report should be carried out in combination with the interconnection of the powers mentioned in this report.

TABLE V.—DISCHARGE OF YADKIN RIVER AT DONNAHA—1913-1920

Month	Discharge in Second-feet				Run-off Inches on Drainage Area
	Maximum	Minimum	Mean	Per Square Mile	
1912-1913					
April 11-30	12,000	2,320	3,810	2.38	1.77
May	16,600	2,170	3,990	2.49	2.87
June	5,290	1,460	2,660	1.66	1.85
July	3,680	1,460	1,910	1.19	1.37
August	10,400	1,460	3,010	1.88	2.17
September	5,290	1,050	2,360	1.48	1.65
October	10,700	1,050	2,000	1.25	1.44
November	5,290	1,320	1,710	1.07	1.19
December	6,610	1,460	2,250	1.41	1.63
1913-1914					
October	10,700	1,050	2,000	1.25	1.44
November	5,290	1,320	1,710	1.07	1.19
December	6,610	1,460	2,250	1.41	1.63
January	6,100	1,600	2,270	1.42	1.64
February	5,770	1,880	3,220	2.01	2.09
March	7,630	1,880	2,680	1.68	1.94
April	6,610	2,030	2,960	1.81	2.02
May	4,160	1,320	2,200	1.38	1.59
June	1,880	1,180	1,460	.912	1.02
July	7,630	1,050	2,030	1.27	1.46
August	2,320	815	1,240	.775	.89
September	1,320	720	992	.620	.69
Year	10,700	720	2,070	1.29	17.60
1914-1915					
October	26,400	1,250	4,470	1.31	1.51
November	7,210	1,690	2,510	.738	.82
December	50,200	3,790	12,000	3.53	4.07
January	54,400	4,240	11,300	3.32	3.83
February	24,800	4,400	8,170	2.40	2.50
March	9,580	3,790	5,060	1.49	1.72
April	5,050	3,070	3,810	1.12	1.25
May	8,370	2,800	3,960	1.16	1.34
June	32,800	2,060	5,560	1.64	1.83
July	4,400	1,630	2,540	.747	.86
August	32,800	1,690	6,340	1.86	2.14
September	22,700	1,940	4,520	1.33	1.48
Year	54,400	1,250	5,850	1.72	23.35

TABLE V.—DISCHARGE OF YADKIN RIVER AT DONNAHA, 1913-1920—*Con.*

Month	Discharge in Second-feet				Run-off Inches on Drainage Area
	Maximum	Minimum	Mean	Per Square Mile	
1915-1916					
October	10,100	1,460	2,170	1.35	1.556
November	4,810	1,600	1,942	1.21	1.350
December	14,700	1,600	3,147	1.96	2.186
January	9,370	2,470	3,302	2.06	2.375
February	11,970	2,320	3,619	2.23	2.405
March	3,070	2,030	2,211	1.38	1.591
April	2,170	1,740	1,930	1.20	1.339
May	7,090	1,600	2,221	1.38	1.591
June	6,250	1,740	2,301	1.43	1.595
July	16,600	1,600	4,411	2.75	2.966
August	7,940	2,470	3,517	2.19	2.525
September	4,330	2,030	2,462	1.53	1.706
Year	16,600	1,460	2,769	1.72	23.185
1916-1917					
October	10,100	2,175	2,948	1.84	2.08
November	2,470	1,880	2,063	1.29	1.43
December	2,470	1,880	2,022	1.26	1.45
January	2,770	2,030	2,282	1.43	1.65
February	5,610	2,175	3,094	1.93	2.08
March	9,740	2,310	4,618	2.88	3.32
April	9,370	1,880	2,741	1.71	1.90
May	3,990	1,880	2,216	1.38	1.59
June	2,470	1,880	2,120	1.32	1.47
July	8,310	1,600	2,606	1.63	1.88
August	2,030	1,320	1,465	.915	1.05
September	11,400	1,320	2,153	1.34	1.49
Year	11,400	1,320	2,527	1.57	21.39
1917-1918					
October	3,220	1,180	1,474	.92	1.06
November	6,420	1,180	1,708	1.07	1.19
December	1,880	1,080	1,551	.97	1.12
January	8,310	1,050	2,665	1.67	1.93
February	2,470	1,600	1,904	1.19	1.24
March	2,770	1,460	1,767	1.10	1.27
April	8,990	1,460	2,120	1.32	1.47
May	2,770	1,600	1,712	1.07	1.23
June	8,140	1,320	2,092	1.31	1.46
July	6,750	1,460	2,175	1.35	1.56
August	5,610	1,460	2,275	1.42	1.64
September	3,370	1,600	1,959	1.22	1.36
Year	8,990	1,050	1,950	1.21	16.53

TABLE V.—DISCHARGE OF YADKIN RIVER AT DONNAHA, 1913-1920—*Con.*

Month	Discharge in Second-feet				Run-off Inches on Drainage Area
	Maximum	Minimum	Mean	Per Square Mile	
1918-1919					
October	7,310	1,600	2,355	1.47	1.67
November	3,450	1,670	1,997	1.24	1.37
December	7,770	1,810	2,655	1.65	1.89
January	5,220	1,880	2,881	1.80	2.07
February	3,760	1,810	2,146	1.34	1.51
March	8,480	1,880	2,565	1.60	1.84
April	2,300	1,880	2,082	1.30	1.44
May	7,110	1,880	2,642	1.65	1.89
June	9,690	1,880	3,002	1.87	2.07
July	15,300	1,740	3,872	2.42	1.63
August	3,150	2,170	2,467	1.54	1.77
September	2,920	2,030	2,247	1.40	1.55
Year	15,300	1,500	2,576	1.60	20.70
1919-1920					
October	4,160	2,030	2,272	1.42	1.63
November	2,620	2,030	2,210	1.38	1.58
December	5,210	2,030	2,567	1.60	1.74
January	2,770	1,880	2,127	1.33	1.53
February	4,820	2,030	2,261	1.66	1.92
March	5,930	2,170	3,389	2.11	2.43
April	13,500	2,310	4,533	2.83	3.26
May	2,620	1,880	2,218	1.38	1.58
June	5,930	2,030	2,534	1.58	1.82
July	6,250	2,030	2,624	1.64	1.89
August	11,800	1,880	4,168	2.59	2.98
September	11,000	2,470	3,665	2.29	2.64
Year	13,500	1,880	2,880	1.81	25.00

PART II

WATER POWERS OF WILKES COUNTY

BY

THORNDIKE SAVILLE, Hydraulic Engineer

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PART II

LIST OF MAPS AND PROFILES

[Enclosed in Pocket Attached to Back Cover]

Fig. 1. General Map of Wilkes County.
Fig. 2. Profile of Elkin River.
Fig. 3. Profile of Roaring River.
Fig. 4. Profile of Reddies River with typical cross section.
Fig. 5. Profile of Lewis Fork.
Fig. 6. Profile of Lewis Fork, west branch.
Fig. 7. Profile of Lewis Fork, south branch.
Fig. 8. Profile of typical cross sections on upper Yadkin River.
Fig. 9. Topographic map of Tinsley Shoals.
Fig. 10. Map and profile south fork of New River.

LIST OF TABLES

PAGE

1. Drainage areas and power of Wilkes County streams 34
2. Discharge of Yadkin River at North Wilkesboro, 1903-1907 40

PART II

WATER POWER SURVEY OF WILKES COUNTY

By THORNDIKE SAVILLE, *Hydraulic Engineer*

INTRODUCTION

Location.—Wilkes County is in the northwest section of the State. It is bounded on the north and west by the Blue Ridge and the counties of Alleghany, Ashe, and Watauga, on the west by Surry and Yadkin counties, and on the south by Iredell, Alexander, and Caldwell counties. The Yadkin River runs through the center of the county. The elevation above sea level is generally high, varying from about 890 feet at Lovelace, near the southeast border, to 4,055 feet at Tomkins Knob, on the Blue Ridge.

Climate.—The climate is that of the upper Piedmont and Mountain regions. At North Wilkesboro, the principal city (population 2,500, elevation 970), there is a mean annual rainfall of about 52 inches. At Brewers, elevation 1,950, located 16 miles north of North Wilkesboro, the average mean maximum and mean minimum temperatures are 56.7, 69.5, and 43.9 degrees respectively. The extremes of temperatures at Brewers range from a maximum of 100 to a minimum of —9 degrees Fahrenheit. The average date of the first and last killing frosts is October 14 and April 20, respectively. The climate is considerably more moderate in the southeast section of the county, especially along the valley of the Yadkin. The State Geological Survey arranged with the U. S. Weather Bureau to have a rain gage installed at North Wilkesboro, and records commenced in October, 1921.

Agriculture.—In the central and southeastern parts of the county, especially in the rich and fertile valleys of the Yadkin and its tributaries, a large amount of fine tobacco is raised. In the uplands to the north and west of North Wilkesboro there exists in the "thermal belt" one of the finest fruit-growing regions in the United States, and great quantities of apples, cabbage, etc., are shipped to all parts of the country. The average temperature in the "thermal belt" is approximately 10 degrees higher in winter and 10 degrees lower in summer than in the adjacent valleys. Lately much attention has been given to the raising of corn and wheat, many farmers raising over 30 bushels of wheat to the acre. Wilkes County ranks third in the 100 counties of the State in the number of farms, having over 4,000 in 1920. Lumbering is an important industry, there being over 100,000 acres of virgin and 150,000 acres of second-growth timber available in the county. Ten million feet of lumber are exported annually.

Forests.—North Wilkesboro and Wilkesboro are the center of one of the greatest virgin forest areas of the United States. In Wilkes County

alone there are 100,000 acres of virgin timber land and 150,000 acres of second-growth timber. The former will produce one billion feet of merchantable timber, 700,000 cords of pulp wood, and 700,000 cords of extract wood. The latter will produce 300,000,000 feet of lumber, 2,000,000 cords of extract wood. North Wilkesboro or vicinity should offer most attractive sites for successful operation of the following industries: pulp mills, furniture factories, match factories, handle factories, woodworking factories, ready-cut house factories. There is a larger stand of white pine in Wilkes County, and within a thirty-mile radius of the Wilkesboros than in any other section east of the Mississippi River. Within a thirty-mile radius of the Wilkesboros there are 200,000 acres of virgin timber, and 900,000 acres of second-growth timber, all accessible by good roads or a logging road proposition. Eleven million cords of pulp wood are available in this radius, and it is still growing.

Manufactures.—North Wilkesboro is the greatest manufacturing center in the northwest section of the State, having an annual output of manufactured goods exceeding $8,100,000 in value. There are nine factories in the district making corn mills, which are shipped all over the world. The largest tannery in the State is located at North Wilkesboro, where aboundant supplies of tan bark are readily procurable. The total value of manufactured products from this section is about $11,000,000 annually. The section is especially attractive from an industrial point of view from the cheap water power available, and the excellent labor supply furnished by the native population.

Transportation.—North Wilkesboro is the shipping center for the entire county, and also for a large portion of the adjacent counties of Ashe, Alleghany, and Watauga. This town is the western terminus of the branch line of the Southern Railroad from Winston-Salem and Greensboro. North Wilkesboro is the chief shipping point in the entire State for the export of poultry, hardwoods, roots, herbs, medicinal bark, canned goods, cornmills, and produce. The roads program recently adopted by the State contemplates a number of additional improved roads from North Wilkesboro to the adjacent sections, and as these will be under way early in 1921, large areas of this undeveloped section will be opened up with consequent increase in agriculture and industry. The Wilkes Commercial Club of North Wilkesboro will furnish information relating to the natural resources and other advantages of the region.

Altogether, this section of the State, known long ago as the "lost provinces," bids fair soon to become one of the most flourishing districts, due to improved roads, agricultural advantages in soil and climate, the excellence of the native labor supply, the amount and variety of its natural resources, and the abundance of undeveloped water power so situated as to be economically developed.

A series of definitions of terms used in water power studies and in this report is given on pages 14 and 15 in the Surry County report.

WATER POWERS

The principal streams of the region, in order of importance, are the Yadkin, Roaring, and Reddies rivers and Lewis Fork. The Elkin River cuts across the southwestern edge of the county for a few miles.

A list of the streams of Wilkes County, together with data relating to drainage area, fall, and power is given in Table I. The power shown is continuous, or 24-hour power. Where 10-hour or 12-hour use is desired, the amounts of power shown should be multiplied by 2.4 or by 2, respectively.

ELKIN RIVER

This stream flows in a northwesterly direction in the eastern section of the county, crossing the county line a few miles north of Elkin and emptying into the Yadkin River. There are no large undeveloped powers. The stream itself is not large, and the best site has already been developed by the Elkin Power Company. A fall of 80 feet has been developed for 190 horsepower for use by the town of Elkin. There are two other small developments near Elkin, one belonging to the Elkin Shoe Company and the other to the Chatham Manufacturing Company, both being for 100 horsepower with 12-hour use.

A profile of the river is shown in Fig. 2. The only undeveloped site of any consequence is at station 85+00, where a dam of maximum height of 45 feet would develop approximately 95 horsepower continuously.

ROARING RIVER

This is the largest tributary of the Yadkin in Wilkes County, but in the lower reaches, several miles south of Dockery, the valley is so wide that no good dam sites are available. The best location for a dam in this portion of the river is about three miles below Dockery, at approximately station 270+00 on the profile, Fig. 3. A dam here 150 feet high gives large storage, and the power possibilities are excellent. Such a dam, located less than six miles from the railroad, would give approximately the power shown in Table I. This is equivalent to 7,550 12-hour power during the entire year.

Above Dockery there are numerous excellent dam sites, where dams from 50 to 200 feet high could be readily built. Such dams might serve at first as storage dams to regulate the power developments lower down, but with provision for installing generating equipment as the power market grew. As storage dams alone, such developments would increase the average utilizable yield of the river from 150 to 250 per cent.

TABLE I.—DRAINAGE AREAS AND POWER ON WILKES COUNTY STREAMS

Stream	Location	Drainage Area Tributary in Square Miles	Maximum Fall in Feet	Minimum Power Without Storage 80% Eff.	Continuous Horsepower Available With Storage		
					12 Months	6 Months	3 Months
Yadkin River	North Wilkesboro	490					
	Barlow Shoals	220	100+		2,400	4,800	9,000
	Tinsley Shoals	235	15	350		*580	
	Marley Shoals	250	15	375		*620	
	Dam site between North Wilkesboro and Elkin	560	60		4,600	7,000	12,000
Elk Creek	Mouth	49					
	Dam Site No. 1	47	125		1,100	1,600	2,200
	Wilkes County	24					
	Watauga County	25					
Stony Creek	Mouth	42					
Lewis Fork	Mouth	73					
	East Fork Dam Site	26	50	180	210	295	350
	West Fork Dam Site	31	50	210	250	350	420
	Headwaters, High Head developments			1,500	1,500		
Reddies River	Mouth	93					
	Dam site at town of Reddies River	61	100+		1,110	1,660	3,330
	East Fork	6.9	Individual developments on all these streams (See text)		2,500		
	North Fork	31.4					
	Middle Fork	15.2					
	South Fork	14.5					
Mulberry River	Mouth	43		†			
Roaring River	Mouth	137					
	Dam site below Dockery	120	150		3,275	5,000	8,200
Elkin River	Mouth	35					
	Dam site	23	45	94	140	200	300
Warrior Creek	Mouth	27		‡			
Totals					17,085	20,905	35,800

NOTE.—To obtain 10-hour or 12-hour power multiply figures given by 2.4 or 2.0 respectively.
*Indicates power developed during six high-water months.
†No powers in excess of 250 H. P. ‡No powers in excess of 100 H. P.

REDDIES RIVER

This stream enters the Yadkin at North Wilkesboro. Throughout its lower reaches it has little fall and no good dam sites. There is a small development at North Wilkesboro for 190 horsepower, utilizing a head of 21 feet. Above North Wilkesboro the stream offers no opportunity for any considerable development in excess of 900 to 1,200 horsepower. Below the town of Reddies River, where the topography changes to a mountainous character, there exists splendid opportunity for locating a dam 100 or more feet high to provide excellent storage. The estimated

power is shown in Table I, and is equivalent to 2,200 continuous 12-hour horsepower during the year. A higher dam would develop more. A typical cross section taken at Whittington's mill is shown on the profile, Fig. 4.

On the several forks of the stream above the town of Reddies River numerous excellent dam sites exist. At these sites high dams can be built to develop from 300 to 600 continuous 12-months horsepower, and all of them can be located sufficiently above the Reddies River dam site not to be affected by it. Opportunities exist here for a combination of a number of small automatic stations on the forks to be tied in to a controlling station below Reddies River postoffice, to develop a total of possibly 4,500 continuous 24-hour horsepower during the year. The location of sites for the smaller developments has not been attempted, as they should be planned with a view toward interconnection, and for this purpose a detailed study is desirable. It is evident that sufficient sites exist and can be located easily. Transmission distance to North Wilkesboro is only ten miles from Reddies River.

Some such development as outlined above is probably the most satisfactory and economical method to be pursued in bringing additional power to North Wilkesboro. The smaller developments, of from 300 to 600 horsepower, might be made first, the development above North Wilkesboro next, and the larger controlling development at Reddies River later. The whole should be planned from the start, however, and with a view toward ultimate interconnection. A detailed study of this project might well be made by the town of North Wilkesboro, to outline to prospective industrial enterprises the cheap water power available and the ultimate plan for large development. Industries would then be tempted to locate near the town where rail facilities existed, and enter an association formed to develop the water powers and bring the electricity to North Wilkesboro for use. The plan outlined above appears very attractive, and it is believed would prove relatively economical to carry out.

LEWIS FORK

This stream, like most of the rivers of this section, has no good power possibilities in its lower reaches, due to a wide valley with large sandy bottoms, although there is a steep gradient, as shown by the profile, Fig. 5. The good dam sites exist on the East and West Forks, and cross section of selected sites are shown on the profiles, Figs. 6 and 7. The powers which may be economically developed here are shown in Table I, but the developments are handicapped, due to the limited drainage and storage areas above the dam sites. It will be a long time before these sites can be developed profitably, as other larger and better sites exist nearer North Wilkesboro, which provides the only present market for power.

There exist two or three opportunities for high head development on the headwaters of the Forks. On the East Fork, particularly, a development for between 800 and 1,000 continuous horsepower could be made, utilizing a fall of 800 feet, and with a pipe line between one and two miles long. Such a development could be most advantageously made to tie into the proposed developments on the headwaters of the branches of Reddies River noted in the previous section. On these two streams, Reddies River and Lewis Fork, there is located some 6,000 horsepower which can be economically developed in relatively small units as needed, and all of which is within a radius of 16 miles from North Wilkesboro.

ELK CREEK

Elk Creek is the westernmost stream in the county upon which any considerable power developments may be made. Almost one-half its total drainage area is in Wilkes County, the remainder being in Watauga County. A number of good dam sites exist on the stream in Wilkes County upon which might be constructed dams from 100 to 150 feet in height. A typical development is indicated in Table I. The sites are so far removed from existing markets that it is doubtful if they can be profitably developed at present.

YADKIN RIVER

Between North Wilkesboro and Elkin there are in Wilkes County one or two possible dam sites on the Yadkin River. The maximum development would be for about 60 feet, and would give a continuous 12-months power of about 4,600 horsepower as shown in Table I. Such a development, however, would necessitate relocation of the Southern Railroad between the dam site and North Wilkesboro, and with present undeveloped sites available elsewhere in the region, this would not prove at present an economical development. In the future, however, a development at Bean Shoals, near Shoals Station (see Surry County Water Power Report), to pond water to Elkin, and then a development above Elkin to pond water to North Wilkesboro would make available some 30,000 horsepower for continuous all-the-year-round use. A profile and a plan of the Yadkin River from Salisbury to North Wilkesboro is appended hereto (in pocket), and shows the effect of developments made as described above.

So far as developments on the Yadkin in the near future are concerned, much the best opportunity is afforded at sites above North Wilkesboro. Here, too, a railroad (the Watauga and Yadkin River Railroad) parallels the stream, but for some years this road has not been in operation, and the cost of either buying right of way or relocation should not be excessive. Moreover, low dams may be built to a height of 15 feet without damaging the railroad. The first good site is about nine miles above North Wilkesboro, at Marley Ford. A dam built here to a height of 15 feet would not interfere with the railroad, and would not

back water to the Tinsley Shoals site above. This is an attractive site for location of an industry, as the railroad can readily be placed in serviceable shape and will enable a dam to be constructed cheaply, and later furnish excellent transportation facilities.

Tinsley Shoals.—At Tinsley Shoals, about 12 miles from North Wilkesboro, there are two good dam sites, that at the head of the shoals being the better. A cross section of each is shown on the profile, Fig. 8. Here two 15-foot dams might be built without injuring the railroad, each giving substantially the power as shown in Table I. A map is shown in Fig. 9.

Barlow Shoals.—At Barlow Shoals, about 15 miles above North Wilkesboro, there is an excellent dam site, shown in cross section on Fig. 8. Should a 100-foot dam be built here, flooding out the railroad, a considerable power might be developed as shown in Table I. There is excellent storage above this site, as the river broadens out in the Yadkin Valley. This is a farming region, and flood rights are likely to be expensive. It is possible, therefore, that Marley Ford or Tinsley Shoals would prove a better location for a high dam, inasmuch as there is from 20 to 30 feet fall to be gained by going down the river to those sites. Moreover, this might also affect less certain developments on Elk Creek, which would be eliminated in the lower reaches by a dam at Barlow Shoals. All the sites mentioned offer good opportunities to develop from 2,000 to 3,000 continuous horsepower all the year. Which site should be selected and the height of dam is contingent upon (1) damage to railroad; (2) cost of site; (3) cost of flood rights. A development at Barlow Shoals, of course, still makes it possible to have low head developments with rail facilities at the two lower sites.

SUMMARY

The developments outlined in this report are such as can be economically made on streams in Wilkes County for amounts in excess of 200 horsepower continuous all the year round. There is a total of approximately 18,000 continuous 24-hour horsepower capable of development in Wilkes County within a radius of 20 miles of North Wilkesboro. Of this, about 9,000 horsepower, or one-half the total, can be developed without flooding existing railroads. Actual installations are rarely made for the continuous 24-hour power, since most industries operate on a 10-hour or 12-hour basis. It is probable that it is feasible to install between 25,000 and 35,000 horsepower on streams in Wilkes County, of which between 12,000 and 15,000 horsepower would not interfere with existing railroads.

INTERCONNECTION OF POWER PLANTS

In the development of hydro-electric projects in a new country, such as the region about North Wilkesboro, it is greatly to be desired that all installations be planned with a view to eventual interconnection. In

this way, when the load at one place is high, surplus power from another place may be brought in. It is thus possible to have smaller machinery installations at a given plant, with consequent less idle machinery during periods of average load. Interconnection of plants means much greater economy in operation and usually less initial cost. Frequently, it is possible to do away with steam auxiliary.

Probably in no part of North Carolina are natural conditions and economic considerations so favorable to interconnection as in the territory served by North Wilkesboro. The natural outlet from a vast agricultural, mining, forest, and fruit-growing region, with rapidly expanding local industries and good rail connections, the phenomenal growth of the city seems only to depend upon the initiative of its citizens in exploiting and making available the great undeveloped water power resources. It is to be expected that industries will locate in the neighborhood of the city as cheap power is made available. It will probably be desirable to develop this power at first in small blocks of from 500 to 2,000 horsepower. Numerous sites exist within a 15-mile radius of the city and their location is pointed out in this report. These should all be developed with a view to interconnecting them with each other, and eventually with some large controlling plant.

On the New River in Ashe County is a site owned by North Wilkesboro interests, and capable of developing some 10,000 continuous all-the-year horsepower. The details of this development are shown in Fig. 10, prepared from data loaned through the kindness of Mr. H. C. Landon of North Wilkesboro. This possible development is less than 25 miles from North Wilkesboro, and could be readily developed to supply a large industry and act at the same time as a central station into which all the smaller powers mentioned heretofore could be connected, as well as other moderate-sized developments in Ashe, Watauga, and Alleghany counties. There seems no reason to prevent the growth in this district of great manufacturing centers, since the distribution of large and small water powers is almost ideal. As stated previously, it is the fervent hope of the State Geological and Economic Survey that the several commercial organizations in Wilkes and adjacent counties will unite in having a detailed study made of the water powers of the district, with a view to the preparation of a definite plan for gradual development and interconnection.

For this reason, there has been indicated on the sketch map of Wilkes County a transmission line connecting the principal developments noted above. It is strongly urged that any enterprises looking to the development of one or more sites described herein should consider very carefully the construction of a unit which will fit into this interconnection system. Eventually it is to be hoped that the whole State will be served by a network of interconnected transmission lines.

It is evident that Wilkes County is in a very remarkable position as regards an unusual combination of natural resources in power and

agriculture, combined with excellent labor supply and good transportation facilities. There seems every reason to believe that with proper exploitation of these advantages there is great opportunity for the development in the district tributary to North Wilkesboro of a great agricultural, manufacturing, and industrial region. The North Carolina Geological and Economic Survey will be glad to receive inquiries relating to specific details of the matters outlined in this report, and to bring outside interests in touch with opportunities for locating in Wilkes County.

GAGING STATIONS

The development of water power projects is predicated upon the available stream flow. Consequently, long-period observations of stream flow, covering both wet and dry years, are exceedingly important in considering the water power resources of a region. The North Carolina Geological Survey, in coöperation with the United States Geological Survey, has for many years maintained gaging stations on North Carolina streams. In the Wilkes County district a gaging station was maintained on the Yadkin River at North Wilkesboro from 1903 to 1907, inclusive. The records from this station are appended hereto as Table II. The station was reëstablished in 1920, and daily observations of discharge are now being made. During 1922 there will be established similar gaging stations on Reddies River and Roaring River. It is believed that the data to be obtained from these stations will be of great value in indicating what stream flow may be depended upon for water power developments. The records from these stations will be published annually by the United States Geological Survey in its water resources papers dealing with the South Atlantic States. Records for any particular stream may be obtained by writing to the North Carolina Geological Survey.

TABLE II—ESTIMATED MONTHLY DISCHARGE OF YADKIN RIVER AT NORTH WILKESBORO, N. C.

Drainage area, 498 square miles

Month	Discharge in Second-feet			Run-off	
	Maximum	Minimum	Mean	Second-feet per Square Mile	Depth in Inches
1903					
April 10-30	3,270	1,415	2,064	4.15	3.24
May	1,415	974	1,169	2.35	2.71
June	5,770	890	1,417	2.85	3.18
July	2,170	659	916	1.84	2.12
August	1,380	575	815	1.64	1.89
September	1,530	512	647	1.30	1.45
October	6,220	491	770	1.55	1.79
November	1,115	449	568	1.14	1.27
December	743	365	502	1.01	1.16
1904					
January	860	322	532	1.07	1.23
February	1,730	322	742	1.49	1.61
March	9,300	611	1,171	2.35	2.71
April	935	513	602	1.21	1.35
May	14,500	513	1,467	2.95	3.40
June	4,375	611	1,224	2.46	2.74
July	7,650	513	1,032	2.07	2.39
August	3,950	611	1,059	2.13	2.46
September	1,770	417	594	1.19	1.33
October	417	345	381	.765	.882
November	1,060	369	461	.926	1.03
December	1,285	369	506	1.02	1.18
The year	14,500	322	814	1.64	22.31
1905					
January	3,330	215	720	1.44	1.66
February	2,860	340	929	1.86	1.94
March	1,060	570	740	1.48	1.71
April	2,950	530	772	1.54	1.72
May	3,240	510	1,010	2.02	2.33
June	1,720	410	585	1.17	1.30
July	11,600	530	1,680	3.36	3.87
August	3,420	530	1,200	2.40	2.77
September	6,000	490	819	1.64	1.83
October	2,950	490	608	1.22	1.41
November	510	450	485	.970	1.08
December	7,200	470	1,290	2.58	2.97
The year	11,600	215	903	1.81	24.59

TABLE II.—ESTIMATED MONTHLY DISCHARGE OF YADKIN RIVER AT N. WILKESBORO, N. C.—*Con.*

Month	Discharge in Second-feet			Run-off	
	Maximum	Minimum	Mean	Second-feet per Square Mile	Depth in Inches
1906					
January	11,400	677	2,160	4.32	4.98
February	1,690	840	1,020	2.04	2.12
March	3,710	840	1,460	2.92	3.37
April	3,330	865	1,230	2.46	2.74
May	3,900	677	986	1.97	2.27
June	6,500	677	1,840	3.68	4.11
July	4,100	815	1,550	3.10	3.57
August	17,100	972	2,900	5.80	6.69
September	5,700	1,340	2,110	4.22	4.71
October	17,000	1,720	3,270	6.54	7.54
November	17,900	1,440	2,520	5.04	5.62
December	6,700	1,120	1,710	3.42	3.94
The year	17,900	677	1,900	3.79	51.66
1907					
January	3,710	1,080	1,480	2.96	3.41
February	1,440	890	1,040	2.08	2.17
March	2,310	835	1,180	2.36	2.72
April	3,520	862	1,320	2.64	2.94
May	1,250	755	945	1.89	2.18
June	8,000	920	1,940	3.88	4.33
July	1,820	705	982	1.96	2.26
August	1,080	590	716	1.43	1.65
September	8,500	510	985	1.97	2.20
October	680	490	546	1.09	1.26
November	3,140	490	778	1.56	1.74
December	7,700	550	1,570	3.14	3.62
The year	8,500	490	1,120	2.25	30.48

NOTE.—Discharge above 4,000 second-feet approximate.

NORTH CAROLINA
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